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No. 5

NORTH AMERICAN SPECIES OF THE GENUS RAMALINA

R. HEBER HOWE, JR.

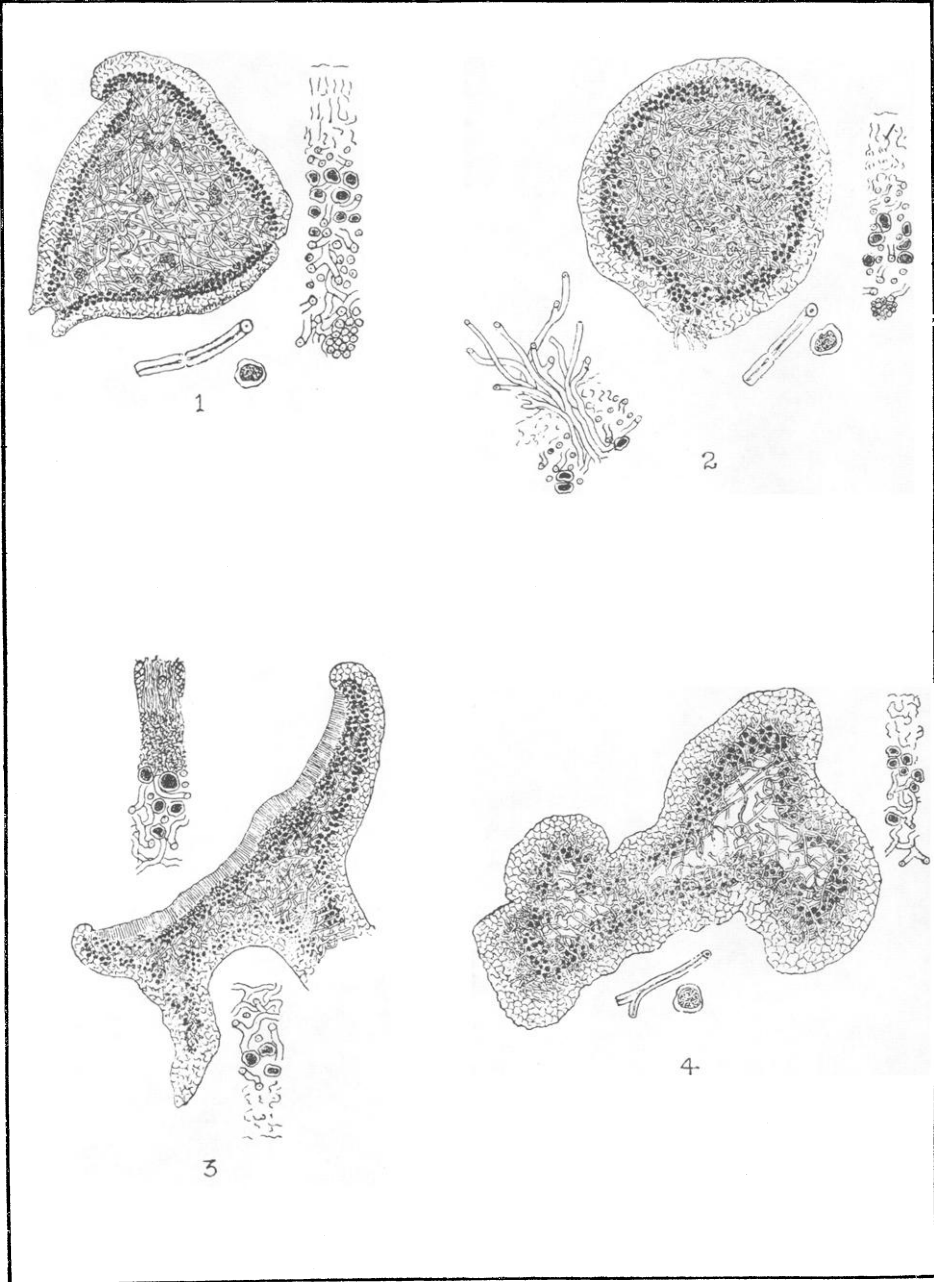
During the eight years that I have been studying the species of the family *Usneaceae* and publishing papers on four of its genera, I have been collecting data on the present genus, realizing that it was one of the most difficult of the family, and until I could study the European types, it was quite impossible to prepare a thorough continental monograph. A year in Europe in 1911-12 gave me this opportunity and I have now traced all the preserved types of which I can secure information and have seen sufficient material to gain a knowledge of the distribution of species.

Our species of the genus *Ramalina*, since 1753, have appeared under the following genera: *Lichen* L., 1753; *Physcia* Pers., 1794; *Lobaria* Hoffm., 1795; *Parmelia* Ach., 1803; *Alectoria* Ach., 1810; *Borrera* Ach., 1810; *Usnea* Tayl., 1847; *Desmaziera* Mont., 1852; and *Cenozosia* Mass., 1853. These comparatively few genera for such a large and diverse group shows the little difficulty lichenologists have found, particularly since 1853, in recognizing the characteristics of the genus. The species, on the other hand, have always presented a most difficult problem, caused largely by the innumerable intergrades that present themselves, and by the unwarranted description of new species.

The genus has received in Europe notable attention, the four following papers being particularly important: Speerschneider, Mikros. anat. Ram., Bot. Zeit. Jahrg. 13: 345-385. 1855; Nylander, Recogn. monograph. Ramalinarum, Bull. Soc. Linn. de Norm., 2 ser. 4: 101-180. 1870; Stizenberg, Bemerkungen zu den *Ramalina*-Arten Europa's, Jahresber. d. Naturf. -Ges. Graubündens 34: 77-130. 1891; Brandt, Beitr. zur anatomischen Kenntnis der Flechtengattung *Ramalina*, Hedwigia 45: 124-158. 1906. Mr. G. K. Merrill, Bryologist 11: 48-53, 1908, has given us an excellent brief review of the commoner North American species, contrasting the Tuckerman and Nylander conceptions.

There has been comparatively little done so far toward the typification of lichen genera, but it is *not* necessary for the retention of *Ramalina* to treat it as a *nomina conservanda*, as Prof. Bruce Fink has intimated (Lich. Minn. 224, 1910). Though Persoon's *Physcia* of 1794 antedates Acharius' *Ramalina* of 1810, Schreber proposed the genus *Physcia* in 1791 (Gen. Plant. 2: 767. 1791). The Acharian genus was well made and it is remarkably coherent, and it is a satisfaction to know that a change which would involve so much confusion is unnecessary.

The July number of THE BRYOLOGIST was published August 21st.



GENUS *Ramalina*¹ Ach. Lich. Univ. 122 et 598. 1810.

DESCRIPTION: *Thallus* caespitose or pendulous, branched; *cortex* glabrous, striate, papillate, rugose, (puberulent?) or ciliate (in one species); structure complex (decomposed); *lacinae* terete, subterete, compressed, or reticulate; virescent to stramineous (rarely dichroic); medulla arachnoid, axis loosely arachnoid (or partially chondroid in a few species). Gonidia stratified (heteromorous), *Protococcoid*. Soredia or soralia normal. *Cephalodia* occasional, pale.

Apothecia terminal, subterminal, marginal or lateral; scutelliform, applanate or concave, rarely convex or lacerate; marginate, disk pale. *Asci* clavate, containing eight spores; paraphyses gelatinous, slender, apices crasate. *Spores* bilocular, rarely tri- or quadri-guttulate, hyaline, straight or curved, ellipsoid or fusiform (rarely bistort). *Spermogones* subimmersed or papillate, dark or pale. *Sterigmata* simple, rarely articulate. *Spermatia* cylindrical, apices obtuse.

OBSERVATIONS: In my papers on the other genera of this family I drew for myself the arbitrary line of the 15th parallel north latitude, and this has forced upon me the consideration of many extratropical species, our field and distributional knowledge of which is seriously lacking. I shall therefore do little more than list the species that have been attributed to Mexico and the Greater Antilles. The material representing the same comprises rarely more than the types. It is interesting to note that almost more species (12) have been described from Mexico and Cuba than from all the rest of North America. In this connection, for example, the genus *Usnea* is represented in North America proper² by only eight distinct species, and in Europe by only nine, whereas from the continents of South America, Africa, Asia, and Oceania one hundred and ten species at least have been described. The reason is not far to seek. The problems of distribution have met with little correlated study, the types are scattered, the described species insufficiently known,—consequently many of the specimens of each small collection that find their way to the botanist, in the absence of comparable material and distributional knowledge are described as new. It is for this reason that in the family *Usneaceae* I am confining my work to North America.

The sections already proposed by Drs. Stizenberg, Steiner, and Wainio do not seem to me particularly satisfactory. One, *Corticatae* Stnr., B. includes such diverse species as *ceruchis* and *Duriaei* their homology being only in a none too well marked cortical structure—which in the entire genus is of the one, *decomposed* type. In fact the members of the genus show but little variation in the essential thalline characters, which undoubtedly explains, as has been said, not only how easily the genus has been recognized, but also the great difficulty in distinguishing species. There are but two really distinctive characters,—one made use of by Tuckerman, the chondroid axial filaments (almost of generic importance) of *ceruchis* and *homalea*,—the other that of spore form. As I have used spore characters, outside of septation, for sectional distinction, they seem to offer again here the most natural division. All measurements and descrip-

¹ *Ramalina* = twigs, shoots—Latin *ramale*.

² See Proc. Thoreau Mus. Nat. Hist. 1: 15-25. 1913.

tions given for species in the present paper refer to plants collected in North America only.

The following herbaria have been examined in the preparation of this work: Sullivant Moss Chapter, Prof. Bruce Fink's, Carnegie Museum, Wellesley College, Academy Natural Science, Dr. L. W. Riddle's, Dr. A. C. Herre's, Dr. H. E. Hasse's, Boston Society of Natural History, Sprague, Taylor, British Museum, New York Botanic Garden and Kew (in part), Museum d'histoire naturelle, Cosson, U.S. National, Victoria Memorial, and the Author's.

SECTION: *Ellipsosporae* R. H. Howe, Jr., Class. Fam. *Usneaceae*, l. c. 17. 1912.

Asci containing 8 hyaline, ellipsoid or oblong spores $\frac{9-20}{3.5-75}\mu$.

SERIES: *Desmazierae* (Mont.) Ann. Sci. Nat. **18**: 303. 1852. (*Corticatae* Stnr. Oesterr. Bot. Zeitsch. **54**: 351. 1904.)

Axis with more or less chondroid, coalescent hyphae, cortex thin (50-60 μ) hyphae not divaricate above gonidia. Spermatogones dark.

The plants of this *Series* show an enormous variation, due to age and character of substrata. Only two distinct types are, however, evident—the two-edged and the subterete. Of these there are those modified by a somewhat constant apothecial position either lateral or terminal and further modifications are seemingly only of growth. The spores of all the species are inseparable.

Key to the Series (*Desmazieræ*)*

Thallus rigid	
Laciniae terete or subterete	
Apothecia mostly lateral	
Branches stout (2 mm. diam.)	
Esoraliolate.....	<i>ceruchis</i>
Sorialiate.....	f. <i>cephalota</i>
Branches slender (1 mm. diam.)....	v. <i>tumidula</i> [<i>humilis</i>]
Apothecia terminal, corymbose.....	<i>combeoides</i>
Branches stout (4 mm. diam.).....	v. <i>robusta</i>
Laciniae subcompressed, angulate or compressed (2-edged)	
Apothecia lateral	
Thalline exciple rugose.....	<i>homalea</i>
Thalline exciple smooth.....	v. <i>disrupta</i>
Apothecia terminal, aggregate	
Branches wide (8-10 mm.).....	<i>testudinaria</i>
Branches narrow angulate, lacunose..	v. <i>intermedia</i>
Thallus lax.....	<i>flaccescens</i>

All specimens show a more or less pale yellow reaction to KOH and hyemium blue with I. Those on mineral substrata show the most pronounced yellow with KOH.

* A general key of all species will be given at the end of this paper.

Ramalina homalea Ach. Type species of the genus.

SYNONYMY: *Ramalina homalea* Ach. Lich. Univ. 598. 1810.

TYPE: In the Acharian herbarium, Universitetets Botaniska Institution, Helsingfors, *vide* Dr. Fred Elfvring. No duplicate material is in the Linnean Society herbarium at London *vide* author.¹

TYPE LOCALITY: "In rupibus Californiae." Menzies.

ORIGINAL DESCRIPTION: "thallo compresso ancipiti laevigato nudo ramoso albo-pallescente transversim subrimoso, ramis dichotomis attenuatis; apotheciis sparsis centro affixis concaviusculis subimmarginatis concoloribus." *l. c.*

FIGURE: Ach., *l. c.*, Pl. XIII, f. 5. and Pl. VII, f. 1.

DIAGNOSIS: *Thallus* caespitose, *compressed, attenuate, rigid, transverse-rimose*, apothecia *lateral*, spores straight or substraight.

DESCRIPTION: *Thallus* caespitose (max. length 12 cm.) rigid, pale virescent to stramineous, becoming reddish in herbarium; *cortex* glabrous, nitidous, sparsely transverse-rimose or rugose (rarely punctate with black spermogones); *laciniæ* compressed, two-edged, subsimple or branched, now laterally digitate (max. width 6 mm.), apices attenuate. *Apothecia* common, lateral, applanate or concave, marginate, at length lacerate (max. diam. 8 mm.), thalline exciple rugose, disk concolorous or pale. *Spores* oblong, straight or substraight, $\frac{9.7-19}{3-5} \mu$.

CONTINGENT PHASES: (a) Margins of laciniæ isidiiferous. (*R. homalea* f. *isidiosa* Willey MS. (b) Blackening.

SUBSTRATA: On maritime rocks (sandstone, granite) and trees?

DISTRIBUTION: Common in the Transition Zone on the Pacific Coast from Guadalupe Island, Lower California and Mexico, to San Francisco. It has been collected inland two miles at Pilarcitos Creek cañon (250 ft.) and on San Bruno Mt., at an elevation of 1,300 feet.

STATIONS : CALIFORNIA : San Mateo Co.; Californian archipelago; San Diego; Pilarcitos Creek cañon; Pt. Lobos; San Bruno Mt.; San Francisco Bay; Pt. Como; Mission Dolores.

LOWER CALIFORNIA: Guadalupe Island; Coronados Island.

MEXICO: (No locality given.)

OBSERVATIONS: This species is generally easily recognized on account of its rigid, compressed, two-edged, rimose, never pitted, and rarely floccose thallus. *R. homalea* represents the most internally chondroid common to our area.

EXSICCATI: No. 92. Decades No. Amer. Lich., Cummings, etc., "San Mateo Co., Cal.," Feb. 17, 1893. M. A. Howe.

No. 2. Lich. Boreali-Amer., Cummings, etc., data as above.

NOTE: *Ramalina homalea* var. *disrupta* Nyl. Recog. mono. Ram. 108 [10 1870. The Abbé Hue includes this variety from California. (Lich. Exoti. 53

¹ Bull. Torr. Bot. Club. 39: 203. 1912.

1891). I have not observed the variety, which Nylander defined as follows: "Variat haec Ramalina cortice distincte transversim rimoso et hinc inde obsolete lacunoso-inequali, var. *disrupta*, accedens ad sequentem, a qua differt praecipue receptaculo laevi." It appears to be only a contingent phase at best, differing because of its smooth thalline exciple.

Ramalina testudinaria Nyl.

SYNONYMY: *Ramalina testudinaria* Nyl., Recog. mono. Ram. 108 [10]. 1870.

TYPE: In the herbarium of the Museum histoire d'naturelle, Paris, *fide* Author. Cotype in the Sprague herbarium, Boston Society of Natural History, Boston, *fide* Author.

TYPE LOCALITY: "California." Menzies.

ORIGINAL DESCRIPTION: "Thallus ochroleuco-pallidus vel stramineo-rufescens, rigens, compressus, anceps, lacunose plano-impressiusculus vel rarius sublaevigatus, cortice transversim aut demum areolatim rimoso, parum ramosus, apicibus attenuatis; apothecia carneo-testacea (interdum leviter albocaesio-pruinosa) marginalia vel subterminalia, mediocria vel majuscula (latit. 3-12 millim.), receptaculo lacunoso-rugoso subpedicellato et margine plicato-undulato rugoso tumescente; sporae oblongae rectae velleviter curvulae, longit. 0.010-15 millim., crassit. 0.003-4 millim." *l. c.*

FIGURE: Pl. VII, f. 2.

DIAGNOSIS: *Thallus* caespitose, *much* compressed, *non-attenuate*, *rigid*, *transverse-rimose*, apothecia mostly *terminal*, aggregate. *Spores* oblong, straight or substraight.

DESCRIPTION: *Thallus* caespitose (max. length 6 cm.) rigid, virescent to rufescent; *cortex* glabrous, transverse-rimose or rugose; *laciniae*, compressed spatulate, two-edged, subsimple or branched, expanded and digitate above or laterally (max. width 2.5 cm.), apices blunt-attenuate. *Apothecia* common, subterminal, or terminal, often aggregate, applanate or concave, marginate at length lacerate (max. diam. 10 mm.), thalline exciple rugose, disk concolorous. *Spores* ellipsoid, straight or substraight, $\frac{10-21}{3-6} \mu$.

CONTINGENT PHASES: (a) Angularly terete, lacunose (*R. testudinaria* v. *intermedia* Müll. Arg. Flora 40: 300. 1882.)¹

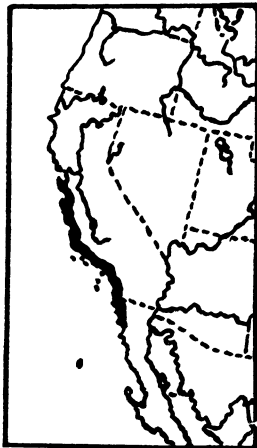


FIG. 1.—Distribution of *Ramalina homalea*, *R. testudinaria*, and their varieties.

¹ Type in Herbar Boissier, Chambésy, Switzerland. "Laciniae primariae circ. 4 cm. longae .5-3 mm. latae, in sectione undique terestiusculae, caeterum undique acutius angulosae et foveolato—et plano-impressae, superne subinde brevi spatio 3-plo laterioris v. undique aequal's." In California.

SUBSTRATA: On maritime rocks.

DISTRIBUTION: Uncommon in the Transition Zone on the southern Pacific Coast. Seen only from the following stations:

STATIONS: CALIFORNIA: Pt. Lobos; Pt. San Pedro; Catalina Island; San Diego; Monterey.

LOWER CALIFORNIA: Guadalupe Island.

OBSERVATIONS: This Nylander species, not recognized by Tuckerman, seems possibly to deserve recognition as more than a phase of *homalea*. Its shorter, more spatulate, dull laciniae and terminal apothecia may deserve for it nomenclatural designation. It occurs with *homalea* and intergrades with the type. Neither Drs. Hasse or Herre, to both of whom we are indebted for so much of our knowledge of Californian lichens, have recorded the species. Several specimens in Dr. Hasse's herbarium are, however, referable to it. Both this and *homalea* rarely show the floccose condition described below.

Ramalina ceruchis (Ach.) DeNot.

SYNONYMY: *Parmelia ceruchis* Ach. Meth. Lich. 260. 1803.

Ramalina ceruchis DeNot. Frammenti Lich., Giorn. Bot. Ital. 2: 218. 1846.

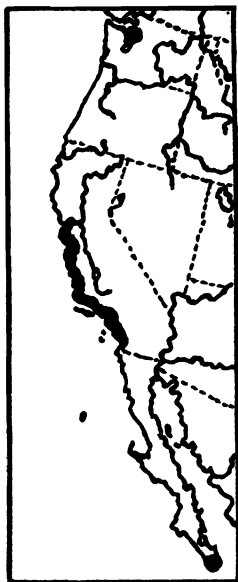


FIG. 2.—Distribution of *Ramalina ceruchis*.

TYPE: In the Acharian herbarium, Universitets Botaniska Institution, Helsingfors, *vide* Dr. Fred. Elfving. Duplicate material is in the Linnean Society herbarium, London, *vide* author.

TYPE LOCALITY: "Peru. Ind. Orient. Koenig." Lima.

ORIGINAL DESCRIPTION: "thallo membranaceo albo-virescente ramoso, ramis vagis laxis inaequalibus subfasciculatis acuminatis; scutellis sparsis crassis disco plano albo-incarnato." *l. c.*

FIGURE: Pl. VII, f. 3.

DIAGNOSIS: *Thallus* caespitose, *subterete*, *attenuate*, *subrigid*, transverse-rimose, *black punctate*, apothecia *lateral*, spores straight or substraight.

DESCRIPTION: *Thallus* caespitose (max. length 8 cm.), subrigid, virescent, stramineous to orange or pale rufescent (dark below); *cortex* glabrous, transverse-rimose, subrugose, generally foveolate, punctate with black spermogones; *laciniae* subterete, simple or subsimple or sparsely branched (max. width 2.5 cm.) apices attenuate. *Apothecia* not uncommon, lateral, concave, applanate, or convex marginate, at length lobate (max. diam. 7 mm.), thalline exciple glabrous, disk buff, often pruinose.

Spores oblong, straight or substraight, $\frac{11-20}{3.5-5}\mu$.

CONTINGENT PHASES: (a) With bluish-gray, capitate soralia (*Ramalina ceruchis* f. *cephalota* Tuck. Synop. N. A. Lich. 21. 1882).¹

(b) Blackening.

(c) Deeply lacunose (*R. testudinaria* v. *humilis* Müll. Arg. Flora 40: 300. 1882.)²

SUBSTRATA: On shrubs, trees, old wood, and on maritime rocks (sandstone).

DISTRIBUTION: Not uncommon in the Transition Zone on the Pacific Coast from San Juan Island, Washington (Bryol. 14: 36. 1911,) to Mexico.

STATIONS: CALIFORNIA: San Francisco; Santa Barbara; Catalina Island; Point San Pedro; Point Lobos; Pigeon Point; Pacific Grove; Clifton; Golden Gate; Newport; San Diego; San Monica Mts.; Santa Cruz Island; Los Angeles Co.; San Clementi Island.

LOWER CALIFORNIA: Guadalupe Island; Cedros Island.

MEXICO: Tia Juana.

WASHINGTON: San Juan Island; Friday Harbor; Kanaka Bay.

OBSERVATIONS: This generally corticolous species may be distinguished from the two preceding by its subterete, more conspicuously punctate and less branched thallus. The older plants and those preserved in herbaria are often partially covered with a white or gray, cottonous, floccose down, resembling superficially a minute mould. This curious condition is explained (See Pl. V, f. 2.) by the medullary hyphae bursting through the rimose articulations. The common cephaloid, soraliate phase, probably due to a more moist rather than a sunlit exposure, does not deserve specific rank. It occurs only in the more slender corticolous plants, so far as I have observed.

EXSICCATI: No. 26, Lich. Exsic., Merrill, near San Diego, Cal. Sept., 1888. E. Palmer.

Ramalina ceruchis var. *tumidula* (Tayl.) Nyl.

SYNONYMY: *Usnea tumidula* Tayl. Hook. Jour. Bot. 6: 191. 1847.

Ramalina ceruchis f. *tumidula* Nyl. Recog. mono. Ram 107 [9]. 1870.

Ramalina ceruchis var. *gracilior* Müll. Arg. Flora 46: 20. 1888.

Ramalina testudinaria v. *humilis* Müll. Arg. (?)

TYPE: Not preserved in the Taylor herbarium, Boston Society of Natural History, Boston, *fide* author.

TYPE LOCALITY: "Coquimbo."

ORIGINAL DESCRIPTION: "thallo cinero, subcaespitoso, erecto, filiformi, dichotomo, glabro-tuberculato, hic illic diffracto, intus albidissime stuppeo-fasciculoso, ramis ultimis brevibus, spiniformibus, apice nigris; gemme com-

¹Type in the Botanic Museum, Harvard University, Cambridge. "Large, lateral and capitate, grey soredia." "Santa Cruz" Anderson.

²Type in Herbar Boisser, Chambes, Switzerland. "Thalli laciniae 2½-3 cm. longae, undique in sectione teretiusculae et crebre alveolato-impressae, steriles subulatae et arenatae, fertilis linearis et magis rectae, firmae." "In Californica insula Guadalupe."

presso-granulatis, laevibus, demum pulverem albidum effudentibus; apotheciis minutis, nudis, sessilibus, demum planis, pruinosis, concoloribus, margine demum crenulato." *l. c.*

OBSERVATIONS: This also corticolous variety, first described as an *Usnea*, appears to be only a slender, though the commonest phase of the type, (due to a latitudinal reduction) occurs throughout the range of the species and bears commonly the capitate soralia referred to under *ceruchis*. The Abbé Hue recorded this slender phase from Laguna (Lich. Cal. 2. 1895), his plant being slightly more slender than most of the material common to our area.

Ramalina flaccescens Nyl.

SYNONYMY: *Ramalina flaccescens* Nyl. Recog. mono. Ram. 109 [11]. 1870.

TYPE: In the herbarium of the Museum histoire d'naturelle, Paris.

TYPE LOCALITY: "Chile prope Coquimbo et in Peruvia, San Lorenzo."

ORIGINAL DESCRIPTION: Thallus ochroleuco-pallidus vel stramineo testaceus, molliusculus, compressus, lineari-laciniatus, lacunose plano-impressiusculus vel subreticulato-lacunosulus, laciniis (latit. 1-2 millim.) laciniato-divisis, apothecia pallida (caesio-pruinosa) minora (latit. 1-2 millims) receptaculo subtus sublucunoso-inaequali; spora oblongae rectae vel leviter curvulae, longit. 0.012-16 millim., crassit. 0.0035-0.0045 millim." *l. c.*

OBSERVATIONS: I have seen but one specimen of this rather questionable species. It was collected at San Diego in 1882 by Dr. Ed. Palmer and is preserved in the Sullivant Moss Society herbarium (No. 349). The specimen is longer than cited by Nylander and has wider spores, in all other particulars agreeing with the original description.

Ramalina combeoides Nyl.

SYNONYMY: *Ramalina combeoides* Nyl. Recog. mono. Ram. 107 [9]. 1870.

TYPE: In the Nylander herbarium, Universitetets Botaniska Institution, Helsingfors, *fide* author. A topotype is in the Sprague herbarium, Boston Soc. Nat. History, Boston, *fide* author.

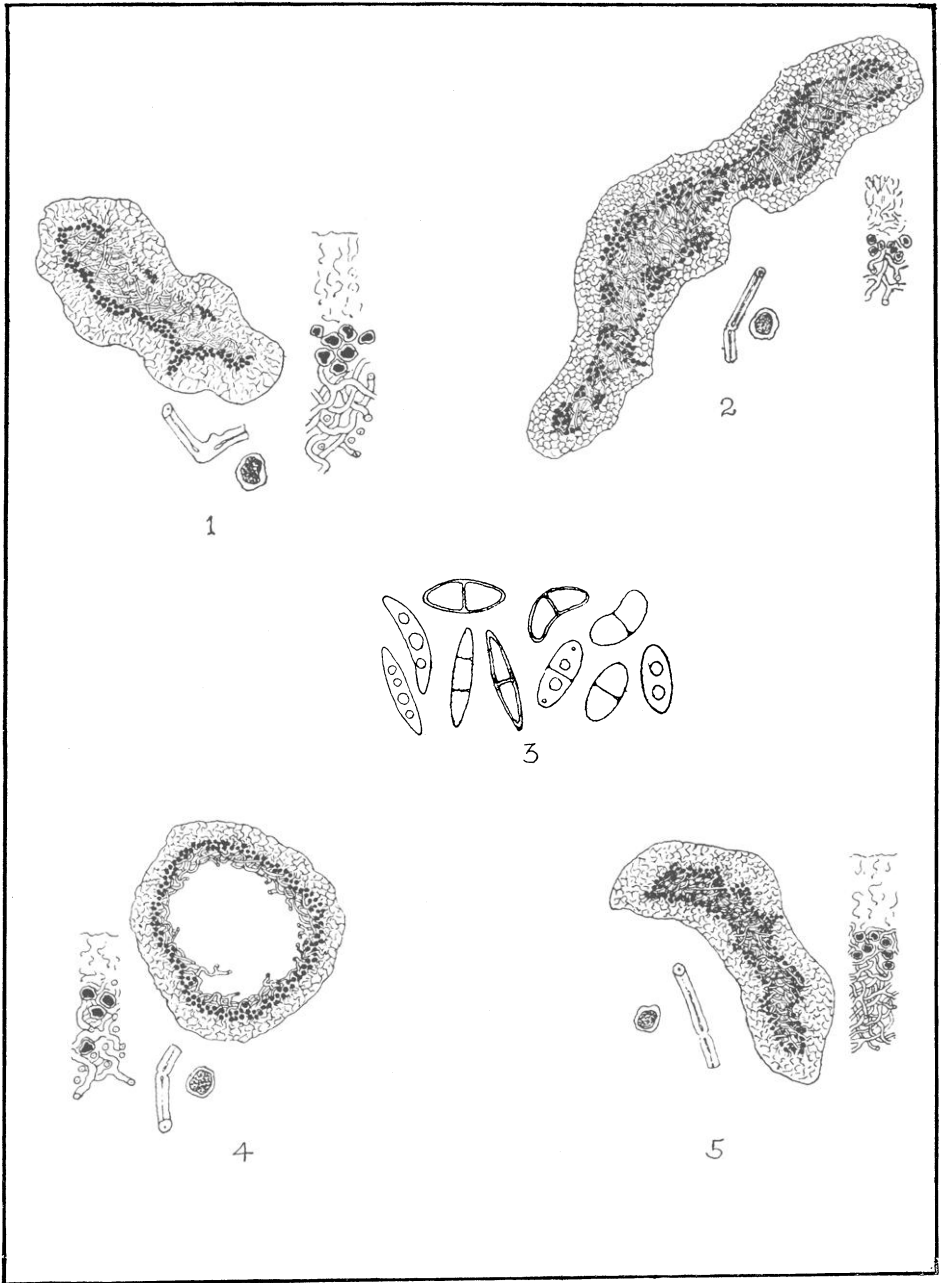
TYPE LOCALITY: "San Francisco," California. Bolander.

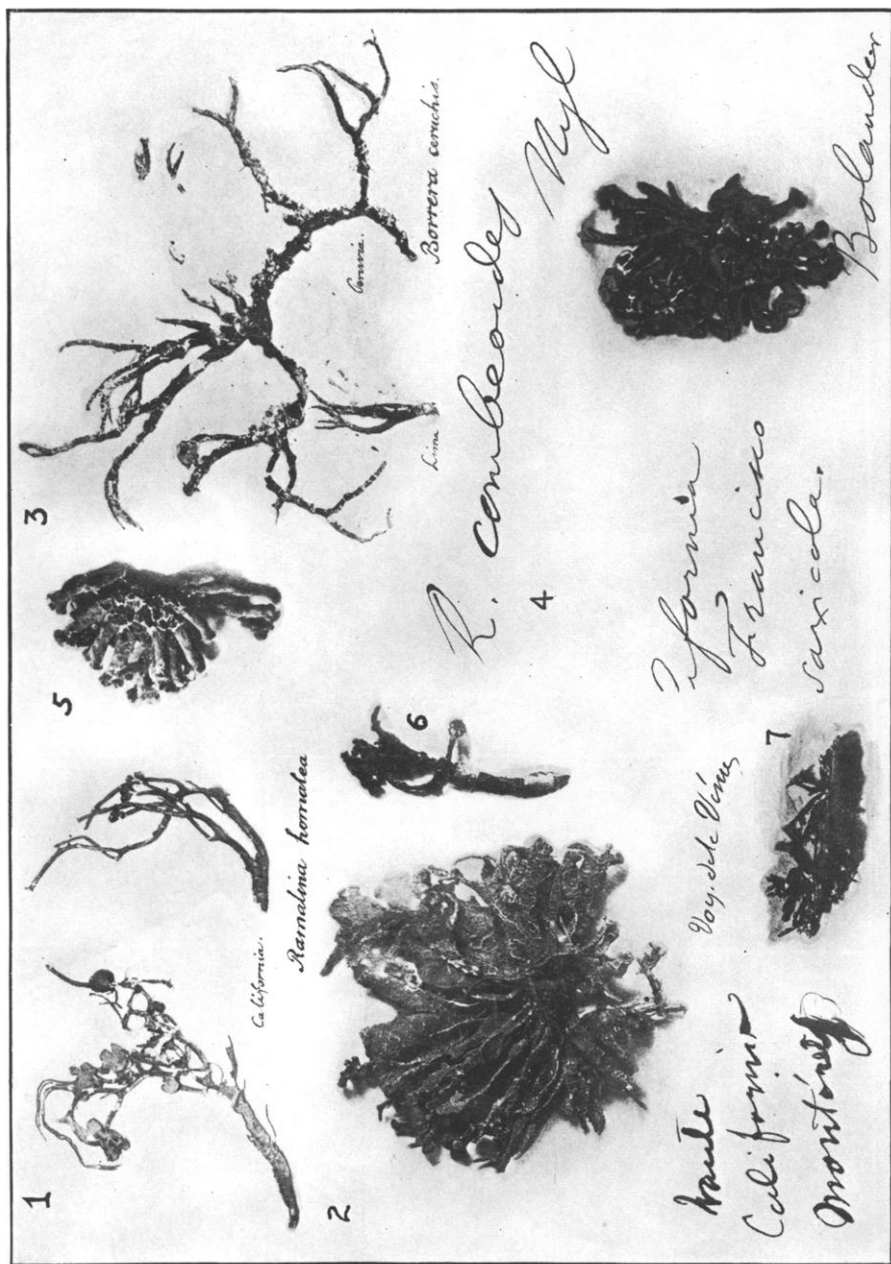
ORIGINAL DESCRIPTION: "Thallus osseo-pallidus vel stramineo-albidus teres, rigens, laevis (altit. 1-2 centim., crassit. 0.8-1.6 millim.), caespitose congestus, e stipitibus podetiiformibus simplicibus constans; apothecia pallido-glauca vel albocaesio-pruinosa, terminalia, plana (latit. 2-4 millim.), fastigiata, receptaculo laevi; spora oblongae leviter curvulae vel subrectae, longit. 0.011-15 millim., crassit. 0.004-5 millim." *l. c.*

FIGURE: Pl. VII, f. 4.

DIAGNOSIS: *Thallus* caespitose, *terete*, *podetiiform*, rigid, transverse-rimose, apothecia *terminal*, spores substraight.

DESCRIPTION: *Thallus* caespitose (max. length 4 cm.), subrigid, virescent, stramineous or pale cinereus (dark below); *cortex* glabrous, transverse-rimose, sublacunose; *lacinae* terete or subterete, simple, podetiiform (max. width 2 mm.). *Apothecia* common, terminal, applanate, or convex, marginate (max. diam. 7 mm.), thalline exciple glabrous, disk buff. *Spores* oblong, substraight, $\frac{8-20}{3.5-5} \mu$.





CONTINGENT PHASES: (a) Laciniae deformed and deeply pitted, thalline exciple rugose. (See Hasse, Contributions U. S. Nat. Herb. 17: 106. 1913.).

(b) Laciniae stout, swollen (*var. novo robusta*). TYPE: U. S. Nat. Herb., Agiabampo, Mexico, 1890. *leg.* Ed. Palmer. Similis *R. combeoidi* Nyl., thallus robustior, niger infra (altit. 1.5-2.5 centim., crassit 3-4 millim.), minutae faveolae; apothecia terminalia (latit. 5-7 millim.). Habitat in rupibus. Also seen from Guadalupe Island.

SUBSTRATA: On maritime rocks (sandstone, granite) and, it is said, on shrubs and trees.

DISTRIBUTION: Common in the Transition Zone on the Pacific Coast from Marin County to San Diego, California. It has been recorded inland two miles at Pilarcitos Creek cañon at an altitude of 250 feet.

STATIONS: CALIFORNIA: Monterey; Point San Pedro; San Mateo Co., Catalina Island; San Diego; Mission Dolores.



FIG. 3—Distribution of *Ramalina combeoides*.

OBSERVATIONS: This generally saxicolous species, distinguished by its more podetiiform growth and terminal, corymbose apothecia, was not recognized by Tuckerman. It is often difficult to separate it from *ceruchis*, with which it undoubtedly intergrades, and like *testudinaria* is of doubtful specific rank. There are even phases which approach *homalea* and others which have been referred to *humilis*. The examples of this and the type are always less rigid and typical if growing on wood; in fact the species seem to be largely based on the results of substratal growth.

EXSICCATI: No. 1, Lich. Boreali-Amer., Cummings, etc. "San Mateo Co." Cal., Feb. 17, 1893. M. A. Howe, called *R. ceruchis*.

No. 91, Decades N. A. Lich., Cummings, etc.—data as above.

No. 1369, Krypt. Exsic., Zahlbruckner, Pilarcitos Creek cañon, Cal., A. C. Herre.

[To be continued]

EXPLANATION OF PLATES V-VII

Plate V

1. Transverse section of the thallus of *Ramalina homalea* showing the coalescent hyphae of the medulla and the decomposed cortex of the cortical layer.
2. The same of *Ramalina ceruchis*.
3. Transverse section of an apothecia of *Ramalina canaliculata* showing exciple and the decomposed cortical layer.
4. Transverse section of the thallus of *Ramalina populina* showing the decomposed cortical layer and the arachnoid medulla and axis.

Enlarged 25 diam.—details 300 diameters.

Plate VI

Transverse sections of the thallus of the genus *Ramalina* showing the decomposed cortical layer and the distribution of gonidia.

- | | |
|------------------------------|------------------------------|
| 1. <i>Ramalina rigida</i> . | 3. <i>Ramalina</i> spores. |
| 2. <i>Ramalina Duriaei</i> . | 4. <i>Ramalina pusilla</i> . |
| 5. <i>Ramalina usnea</i> . | |

Cortical layer 20–60 μ thick. Hyphae 2–9 μ in diameter. Gonidia 5–17 μ in diameter.

Plate VII

1. The Acharian type of *Ramalina homalea* at Helsingfors. (Slightly reduced.)
2. The Nylander type of *Ramalina testudinaria* at Paris. (Nat. Size.)
3. The Acharian type of *Parmelia ceruchis* at Helsingfors. (Slightly reduced.)
4. The Nylander type of *Ramalina combeoides* at Helsingfors. (Nat. Size.)
5. The Howe type of *Ramalina combeoides* var *robusta* at Washington. (Slightly reduced.)
6. The Müller Arg. type of *Ramalina testudinaria* var. *intermedia* at Chambésy. (Nat. size.)
7. The Müller Arg. type of *Ramalina testudinaria* var. *humilis* at Chambésy. (Nat. size.)

NOTES ON NORTH AMERICAN SPHAGNUM. V (Concluded)

A. LEROY ANDREWS

11. *Sphagnum teres* (Schimper) Ångström, 1861. This type, distinguished as a variety of the one next following by Schimper in 1858, was regarded by Ångström as a separate species and bryologists have wavered between the two opinions ever since. While inclined from my own experience to separate the two specifically I realize fully their very close relationship. Warnstorff once inverted the relation of the two, making the following a variety of this species.¹ This procedure while nomenclatorially reprehensible was probably based upon a correct feeling for phylogenetic relationships. The two are most readily distinguished from other species of *Litophloea* by their large stem-leaves of elongated lingulate shape with broad and short hyaline cells without fibrils and with extensive membrane-resorption on outer surface, the total effect being well represented by Roth's figures already referred to. Of the two *S. teres* is the more likely to be confused with other species, as in the field it looks not unlike such species as *S. Girgensohnii* or even *S. recurvum*, a fact obviously not without phylogenetic significance. These three species can however be readily distinguished in the wet state by an examination of the stem-leaves with a hand-lens and like all Sphagna are more easily distinguished when dry. Lindberg was the first to note² that the inner walls of the hyaline leaf-cells where overlying the chlorophyll cells are in both *S. teres* and *S. squarrosum* usually minutely papillose. The two species are separated from each other by quantitative macroscopic differences: the greater size of the plants and of some of their parts in *S. squarrosum* and the usually strongly squarrose branch-leaves of the latter species, its individual branch-leaves being then ovate-hastate while those of *S.*

¹ Die europäischen Torfmoose 121. 1881.

² Cf. Braithwaite, Sphagnaceae 62f. 1880.